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NATIONAL REPORT ON STATUS OF CARTOGRAPHY IN ZAMBIA

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1. Introduction

The Republic of Zambia is bounded by the Republic of Angola in the West, Zaire in the North, Malawi and Tanzania in the East, Mozambique in the South-West and by Botswana and Zimbabwe in the South. Zambia has an area of 752,618 square kilometres, lying between 8° and 18° South and 22° and 34° East.

Maps being the most accurate and reliable source of information in any national development and, therefore, the Survey Department has directed itself to exploiting the mapping resources in the country. The Department still looks forward to the new technological advancement in the mapping industry.

1.2 Consequently, as a meaningful effort to achieve this objective, the department has acquired more modern photogrammetric, survey and mapping, photographic and cartographic equipments. It has also secured training places for the young Zambian form V school leavers and other serving officers in these fields.

2. Mapping Activities

The Survey Department is the only mapping agency in the country and as such is constantly under pressure from various institutions for new or updated maps.

The Survey Department is presently engaged in the following mapping activities:

(a) New mapping at 1:100,000 scale of Western and other parts of Zambia;

(b) New mapping at 1:50,000 scale;

(c) Contouring of existing uncontoured 1:50,000 sheets;

(d) Revision of 1:50,000 sheets;

(e) Mapping for engineering and agriculture purposes.

2.1 1:100,000 Mapping

The Department has programmed to produce 60 sheets at 1:100,000 scale covering Western and parts of North Western and Southern Provinces. Presently, these areas are covered by 1:250,000 maps only which were produced some seventeen years ago using mosiacs and templets. So far 19 sheets have been published, 4 sheets are in the process of being published while 17 sheets are available in the form of dyeline prints. The mapping exercise in the above areas which was started in 1980 was hoped to be completed in 1986 but due to some problems arising from lack of materials and inaccessibility in the programmed areas, the exercise will not be completed in 1986 but expected to be completed in 1989.

2.2 New 1:50,000 Mapping

Selected township areas in Western and North-Western Provinces, which are being covered under 1:100,000 mapping, are also being mapped at 1:50,000 scale with 20m vertical contour intervals. Eleven such sheets covering township areas are being produced, 3 have since been published.

2.3 Contouring of existing 1:50,000 sheets

49, 1:50,000 sheets covering Copperbelt and part of North Western Province did not have contours. However, these sheets are presently being contoured using new aerial photography which has also enabled the department to revise the sheets at the same time, all the 49 sheets will have been contoured by the end of 1986.

2.4 Revision of 1:50,000 sheets

The Department is also engaged in the continous process of revising the existing 1:50,000 Maps, especially the sheets covering the line of rail and areas where development projects are taking place.

2.5 Mapping for engineering and agriculture purposes

The Department is also engaged in producing large scale mapping covering townships and their outskirt areas. These maps are required for communication and town planning purposes. Maps are also being prepared for Agriculture Department, needed for its irrigation schemes and/or soil conservation programmes. Scales involved in this category are 1:2,500, 1:5,000 and 1:10,000.

3. Aerial Photography

Aerial photography has been used for different purposes in Zambia for many years. Survey Department is maintaining an air photography library with complete photographic cover of Zambia. The first air photos in the photo library date back to 1928, but a programme to cover the whole country with aerial photography started in 1954 and there is up-dating of the cover every year.

Aerial photography is the base for all topographic mapping in Zambia today. Air photos are also used extensively in agriculture for planning purposes, in searching for water and mineral resources, for planning of urban areas, for soil surveys, for different purposes in forestry etc.

It has to be noted that Zambia has a very good air photo coverage as compared to many neighbouring countries and it is no doubt that aerial photography will continue to be a very useful tool in the development of Zambia.

4. Photogrammetric activities

All the topographic mapping in Zambia is undertaken using photogrammetric methods. Presently, all the photogrammetric mapping activities are as listed under 2 of this report. Besides topographic mapping, photogrammetry is also being used in cadastral survey.

Photogrammetry is being used for the extension of mapping control using AIM method followed by strip or block adjustment on IBM 4341 computer.

5. Cartographic activities

Production and revision of a wide range of topographic maps for use in administration, engineering, defence, tourism, educational development, planning etc. has increased considerably during this year. 90 per cent of Zambia has been mapped at the scale of 1:50,000, being the largest national mapping series in the country. These are constructed from the latest available aerial photography. Most of the old contoured sheets have been recompiled and constructed to metric system at 20 metre vertical contour interval.

5.1 Thirty sheets of 1:100,000 series have been drawn, out of which 26 have been published, these cover only a small area in both Luapula, Northern, Western and North Western parts of Zambia. The section has planned to cover other remaining areas at phases I, II, III and IV in the western part of Zambia.

5.2 Four sheets of 1:750,000 series covering the whole Republic of Zambia have been drawn and published, these are numbered as North East, North West, South East and South West of Zambia. They are provisional specification.

5.3 The 1:250,000 scale of mapping is also being undertaken in the department. There are 54 sheets at this scale covering nearly the whole country, which are up-dated whenever a source of material, i.e. 1:50,000 map series recently revised is available. The maps are produced in seven colours with 50 metre vertical contour interval.

5.4 The Cartographic Section is also charged with the responsibility of revising from time to time the 1:1,000,000 International Civil Aviation Organisation Charts (WAC) and these are sheets Nos. 3054 Kasama, 3152 Lusaka and 3153 Blantyre. 1:1,500,000 relief Map of Zambia has also been up-dated and published.

5.5 National Atlas

The Department is engaged in the preparations of the National Atlas of Zambia.

The first edition was prepared by the Colonial Government. A number of maps were revised during the late 1960's and early 1970's, but details on most of these maps are now out of date.

In its original loose-leaf format, the National Atlas of Zambia emphasized the physical geography of the country (for example, vegetation and soils). The proposed revised and expanded edition is designed to present a more comprehensive survey of natural, social and economic conditions in the country. Some of the new topics such as social services, industry, agriculture, communications and urban settlements are particularly intended to reflect the Development of Zambia as an independent nation.

Objects of the Project

The maps to be included in the National Atlas are intended to be of practical use to decision makers in Government and business, regional and national planners,

research scholars and teachers as well as for members of the general public who are interested in distributional patterns of phenomena.

The main objectives of the project, therefore, are:

(a) To compile maps that will illustrate the physical environment and country wide spatial patterns of population, agriculture, industry and socio-economic activities;

(b) To compile and up-date maps that can be used as a basis for informed decision-making and planning;

(c) To promote thematic mapping and spatial analysis relevant to planning and to produce a document that will form a basis for further research and mapping work;

(d) To produce a document that will be of use in schools and institutions of higher education. In order to facilitate the accomplishment of the above tasks, a National Atlas Co-ordinating Committee has been formed.

6. Standardization of Geographical Place Names in Zambia

The Government appointed a standing committee on geographical place names in 1978. The terms of reference given to this committee were to advise the Government on matters relating to geographical nomenclature in Zambia. This committee is composed of Surveyors, - geographers, cartographers, historians, linguists and administrators.

Ever since the committee was appointed, much of its work has been confined to the revision of the National Gazetteer of Geographical Names which was lastly published in 1966. In addition to this revision, the committee is working towards the direction of re-organising the local sub-committee at both provinicial and district levels in order to effectively formulate the policies of the standardization of names in the country. However, the committee's work is being retarded, due to lack of enthusiasm on the part of the appropriate authority towards its effectiveness. The 1966 edition of the National Gazetteer has about 35,000 names, while the current edition is expected to contain about 45,000 names.

7. Photo-reproduction activities

Reprographic section of the Survey Department, having been overhauled by the National Land Survey of Sweden through the Swedish International Development Agency, is capable of performing with greater satisfaction, the following duties:

(a) None rectified enlargements of aerial photographs at various scales on bromide paper, which are used in map production and planning;

(b) Enlargements and reductions of maps, diagrams, survey general plans, etc. at different scales;

(c) Production of Negative/Positive films for both large and small scale maps;

(d) Processing of Diatype and stripping films;

(e) Printing aerial photographs as diapositives and contact prints used mainly by the photogrammetric, cartographic and various planning organisations;

(f) Negative or colour proofing of all maps produced by Survey Department and other organisations in the country.

8. Geodetic Survey Activities

8.1 Triangulation and Trigonometrical Stations

No triangulation and only limited traversing has been carried out since 1983, mainly to third order standard. Some additional low order reference mark surveys have been provided in built-up areas to control cadastral surveys. However, everything is made to make the best use of the existing network of control stations.

8.2 Levelling

The programme of previse motorised levelling along the Great North and Great East Roads continued until 1984. No funds have been available for such work in 1985 and 1986. The long term aim is to complete the levelling on these routes and to connect to precise levelling in neighbouring Malawi. No other levelling has been carried out.

8.3 Doppler Positioning Survey

Doppler fixes for control of new mapping in Western Zambia were completed in 1984 with JMR-1 equipment loaned by the National Land Survey of Sweden as a joint project with the Zambia Survey Department. No further doppler survey is planned, and the Department would now look towards the more economical GPS system if further control at national level is required.

9. Cadastral Survey Activities

Measuring, defining and recording boundary and sizes of parcels of Land for the purpose of effecting their registration in the Deed Registry of the Office of the Commissioner of Lands.

9.1 Regional Survey Offices

The Department has only four Regional Survey Offices at present. However, a fifth one is planned at Kabwe. It is also planned, subject to the availability of funds and accommodation, to decentralize the Department to all provincial capitals. The main activity of the Regional Survey Offices is to carry out cadastral surveys for the purpose of providing diagrams which are the legal requirement in all title deeds for 99 years.

9.2 Examination of Surveys

All Cadastral surveys done by both Government and private Land Surveyors are by law required to be lodged with the Surveyor General for examination and approval. A section within the office of the Surveyor General called Examination Section is responsible for this kind of work.

9.3 Cadastral Drawing Office

Cadastral Drawing Office, a section within the office of the Surveyor General, is responsible for drawing General plans of all parcels of Land Surveys by Government Land Surveyors. It is also entrusted with the responsibility of framing up diagrams and sketch plans for use in the title deeds for 99 and 14 years respectively.

9.4 Property Registration

Property Registration is the responsibility of the Commissioner of Lands and is, therefore, undertaken by his office.

10. Remote Sensing Facilities

Zambia, being a full participating member, is serviced by the Regional Centre for services in surveying, mapping and Remote Sensing, Nairobi, Kenya. Some services on specific Remote Sensing projects for the country have been rendered by the Satimage of Kiruna, Sweden.

10.1 National Remote Sensing Committee

Survey Department of Zambia, in conjunction with other user institutions, has established a National Remote Sensing Committee, whose objective is to promote remote sensing activities in the country and co-ordinate with outside bodies in matters pertaining to development of Remote Sensing.

10.2 Participation in Remote Sensing Activities

The mapping services Branch has participated in the activities by sending its five members of staff to attend short courses in the application of remote sensing at the Nairobi Centre. A senior member of Cartographic Section attended the United Nations Inter-regional training course in thematic mapping in USSR with the use of Satellite Imagery. Locally, the National Remote Sensing Committee mounted a first introductory course in Remote Sensing, and its application in the field of Agriculture, Forestry and related subjects. This course attracted the attendance of 13 participants drawn from department of Agriculture, Forestry, Natural Resources, Soil Survey Unit, Statistics, Geography, Surveys and National Council for Scientific Research. The course was very successful and similar other courses are planned.

10.3 Applications of Remote Sensing

(A) The Government of the Republic of Zambia through the soil survey unit of the department of Agriculture and the mapping services branch of the Survey Department, with the co-operation of the Regional Centre for Services in surveying, mapping and remote sensing, Nairobi, embarked on a project titled "North Western Province Area Project" (1:500,000 Soil mapping), the objective of the project was to provide an inventory of the major land types in the project area. The project covered a total of 82,091 square kilometres in the Kasempa, Solwezi and Mwinilunga districts of Zambia;

(B) The Landsat Imagery was also applied in the study of the flood plains of Kafue river by the department of Geography at the University of Zambia,

(C) Geological Survey Department used satellite Imagery in its geological interpretations for exploration of minerals.

In project (A) above:

It resulted in the production of

(i) 1:500,000 Soil map,

(ii) Descriptive report of major soils for future economic evaluation;

(iii) Training of Zambian personnel to continue with similar projects in other selected areas.

In project (B) above:

It was found out that Landsat pictures could:

(i) give useful information on ground water level;

(ii) distinguish between areas of subsistence farming and adjacent areas where farming and settlement are prohibited;

(iii) in certain cases, distinguish between commercial and subsistence farming areas;

(iv) in August, pictures show very clearly some irrigated areas;

(v) record both annual and seasonal changes of flood plains;

(vi) give rather detailed mapping and measurements over large areas.

In project (C) above:

(i) landsat Imagery was used to check the flight paths and plot magnetic anomalies.

10.4 Future applications

Presently, Forest Department is looking into possible use of Remote Sensing in monitoring deforestation and to carry out a national forest inventory. The Department of Water Affairs is also planning the use of satellite imagery to find out the causes of soil erosion which is taking place at an alarming rate in Luangwa Valley covering about 14,000 km^2.

Zambia is also to participate in the project of early warning and crop forecasting with the use of Satellite imagery through SADCC in conjunction with FAO.

11. Training Needs

As new methods and techniques become applicable, the need for trained personnel becomes greater. The need for special training arose when survey department used doppler control for the first time, in its 1:100,000 mapping project. Field personnel were given "on the job" training, whereby the staff learnt how to handle and use JMR equipment. Purchase of small desk top computers for the computation of field data, necessitated training of field staff not only in the use of computer but also to write their own basic programme. Use of new tools in cartographic section and purchase of new equipment in photogrammetric and Reprographic sections necessitated training of staff both locally and abroad.

In the field of remote sensing, basic training has been undertaken by some staff members at the Regional Centre in Nairobi, however, further training will be necessary as more and more application of this science is made and equipment to handle each data is purchased.

There is a continuous need to train not only the new staff in different sections of the department, but also to arrange refresher courses for the senior staff members, so that these can keep abreast of the new developments in their respective fields.

12. Conclusion

Although the Survey Department is not a very large institution, it has used its resources to the optimum with the result, the mapping in Zambia has reached high standards with very good national coverage.

13. Index diagrams are attached for illustration.